REMARKS

This is in reply to the Office Action dated January 14, 2005. Claims 1-40 are listed as pending in the Action. Claims 2-3, 9 and 25-40 have been cancelled, and claims 1, 4-8 and 10-24 remain pending in the application.

Rejections under 35 U.S.C. § 103

On page 8 of the Office Action, the Examiner has also rejected claims 1-24 under 35 U.S.C. § 103(a) as being unpatentable over Maeda et al. '771, in view of Sato et al. '846, Baney et al, "Silsesquioxanes" Chem. Rev. vol. 95(5) pp. 1409-1430 and Krug et al., "Fine Patterning of Thin Sol-gel Films," J. non-cryst. Sol. Vol. 147/148 pp. 447-450, (1992).

Applicants' representative appreciated the opportunity to speak with the Examiner on July 11, 2005 regarding the present application and respectfully notes the Examiner's willingness to receive a submission of experimental data from Applicants. It is Applicants' intention to present data to the Examiner showing that "the organic-inorganic hybrid polymer of the present invention is excellent in a film physical property."

Specifically, the data will demonstrate that the present invention is superior in film physical properties to the cited Maeda et al. and Sato et al. references.

As for a superior refractive index modulation amount, the values of Example 1 and the cited Sato et al. reference are compared in order to show that the present invention has a superior refractive index modulation amount. A superior refractive index modulation amount and film physical property of the organic-inorganic hybrid polymer of the present invention are supported by page 9, line 13 to page 10, line 1 and page 11, lines 4-11 of the present specification.

Applicants respectfully traverse the 35 U.S.C. § 103(a) rejections and respectfully submit that the combination of these references should not be deemed proper under the Law, as there is

no motivation, either explicator implicit, directing one of ordinary skill in the art to look to each of these references individually and thereafter pick and choose elements to ultimately arrive at the claimed advertising system of the instant application. Applicants further submit that even if it were permissible to combine these three references, the claimed invention could not be considered to be obvious as certain features of the references are directed to divergent subject matter. There is no teaching for one skilled in the art to pick and choose certain elements from any of these three references and modify certain elements to achieve what Applicants have discovered, set forth and claimed.

Applicants' reasoned arguments supporting this assertion and distinguishing the claimed advertising system over the art of record are as follows:

A photosensitive composition and a photosensitive medium for volume hologram recording of the present invention is provided in claims 1 and 8 as provided. One feature of the present invention is the use of an organic-inorganic hybrid polymer having a metal component capable of performing hydrolysis and polycondensation on a principle chain of an organic polymer in a pendant shape and an organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation in combination. Hydrolysis and polycondensation can be performed between each metal. Thereby, the resultant film has a flexible portion and a durable portion in the chain, and a refractive index of the film obtained can be changed by incorporating the metal atom therein. That is, by using the organic-inorganic hybrid polymer and the organometallic compound represented by the general formula 2 in combination, it can significantly improve a film physical property in comparison to the instance of using the organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation, as it can increase the change in refractive index of the film itself in comparison to using the organic-inorganic hybrid polymer alone.

A surprising technical advance is achieved when the photosensitive composition of the present invention and the photosensitive medium are used for volume hologram recording. Firstly, the difference of refractive indices between a photopolymerization reactive compound, which diffuses and shifts, and a film itself can be enhanced. As a result, a refractive index modulation amount of an exposed region can be enlarged. Secondly, having a flexible portion and a durable portion in the chain, as a film physical property, the film obtained has the flexibility that the organic polymer has and the durability and the heat resistance of the inorganic polymer has in combination providing excellent processing properties. Moreover, the compatibility with a photopolymerization reactive compound is better or more enhanced when just an inorganic polymer, is utilized. The photosensitive composition for volume hologram recording is easily prepared to be a uniform coating liquid. Therefore, the present invention, as now claimed recites a photosensitive composition and a photosensitive medium, which is capable of realizing a large refractive index modulation amount and obtaining a volume hologram with excellent physical properties.

In paragraph 18 of the Action, the Examiner states that it would have been obvious to modify the process of Maeda et al. by using producing a reactive sol-gel matrix containing epoxide moieties in view of the disclosure of Sato et al. It is stated that these would be compatible and that epoxide containing reactive binder are desirable in holographic recording media, using technique similar to those disclosed by Baney et al. and Krug et al. to form the epoxide containing polymerizable matrix.

Maeda et al., '771 discloses an optical holographic film using both an inorganic material network and a photopolymerizable monomer (see claim 1), and a sol-gel processing.

At column 6, lines 63-67 it is stated, "The silicon compound includes silanol-terminated polydialkylsiloxane, epoxysilane and aminosilane. The silicon compound bonds to the gel formed from the metal compound (C) to impart the gel with flexibility."

Sato et al, '846 discloses a composition for volume hologram comprising a cationic polymerizable compound, a radical polymerizable compound, a cationic polymerization initiating material and a radical polymerization initiating material, wherein at least one of the cationic polymerizable compound and the radical polymerizable compound has a siloxane group is disclosed. (See claim 1).

Sato et al. assumes that the refractive index modulation is improved since a compound having a siloxane group is liable to move in a hologram producing process (an interference exposure step) from the dark part to light part of the interference fringe, thereby increasing the degree of separation in concentration between them (see col. 8, lines 38-51).

The polymerizable compound having a siloxane group used in the Examples is disclosed as having a refractive index of 1.49 or less. It is further mentioned that a silane coupling agent may be further contained as an optional additive at col. 7, line 11 of Sato, however, the silane coupling agent is not disclosed in any of the Examples.

Also, it is mentioned that a polymer binder may also be contained as an optional additive. It is necessary for the polymer binder to have good compatibility with component (A), a polymerizable polymer. Although the polymer binder is mentioned that it may have a reactive group such as a cationic polymerizable group (col. 7, lines 15-24), in the Examples, a methyl methacrylate/ethyl acrylate/acrylic acid copolymer is used.

Baney et al., Chem. Rev. vol. 5 at pages 1409-1430 discloses techniques for forming organic/inorganic hybrid, including those containing moieties which may be photocured, such as epoxides and vinyl moieties.

Krug et al., J. non-cryst. Sol. Vol. 147/148 teaches the method for forming photocurable sol-gel polymers where methacrylate monomers are reacted with alkoxides and then with other monomers.

As mentioned in the previous action, a feature of the present invention, the changing of the refractive index, can be achieved is by using an organic-inorganic hybrid polymer including a metal component capable of performing hydrolysis and polycondensation on a principle chain of an organic polymer in a pendant shape and an organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation in combination. The resultant film has a flexible portion and a rigid portion in the chain. Thereby, the film has the desired physical properties of flexibility imparted by the organic polymer, rigidity and heat resistance imparted by the inorganic polymer when used in combination thus achieving these excellent processing properties.

Maeda et al. only mentions that a network structure solely comprised of chains of mutually bonded inorganic compounds, and an organic group may be introduced as a side chain of the network structure of the inorganic network in a pendant shape. The Maeda reference mentions nothing about an organic-inorganic hybrid polymer having a metal content capable of performing hydrolysis and polycondensation on a principle chain of an organic polymer in a pendant shape. Hence, there is no mention of using the organic-inorganic hybrid polymer and the organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation in combination.

Further, since the network structure of Maeda is solely comprised of chains of mutually bonded inorganic compounds, the benefit of utilizing the organic-inorganic hybrid polymers is not experienced when the film is processed. This problem was both recognized and overcome by

the inventors of the present invention by utilizing the organic-inorganic hybrid polymers. The Maeda reference does not recognize such a problem nor provide any solution.

Therefore, the effect of the present invention of using the organic-inorganic hybrid polymer and an organometallic compound capable of performing hydrolysis as well as polycondensation in combination, having a refractive index of a film obtained itself which can be changed and a film physical property such as flexibility and excellent properties is submitted to be novel and unobvious over this reference. Furthermore, the compatibility with a photopolymerization reactive compound and the photosensitive composition for volume hologram recording being easily prepared to be a uniform coating liquid so as to improve handling is simply not anticipated by Maeda et al.

Sato et al. does not mention the organic-inorganic hybrid polymer which is obtainable by copolymerizing an organometallic compound represented by the general formula 1 and a monomer having an ethylenically unsaturated bonding. Thus, there is no mention of using the organic-inorganic hybrid polymer in combination with the organic metal compound represented by the general formula 2 capable of performing hydrolysis and polycondensation.

Sato mentions that it is necessary for the polymer binder to have a good compatibility with a component (A) a polymerizable polymer, and that the polymer binder may have a reactive group such as a cationic polymerizable group. However, from this disclosure, it cannot be considered to be anticipatory to use the organic-inorganic hybrid polymer which is obtained by copolymerizing an organometallic compound represented by the general formula 1 and a monomer having an ethylenically unsaturated bonding such that, a film physical property, has the flexibility, that the organic polymer has including rigidity and heat resistance which results from the inorganic polymer used in combination so as to have an excellent processing properties.

On the other hand, as it is clear that the compound including a siloxane group is used as a refractive index modulation component (a photopolymerizable compound) for forming an interference fringe by changing the refractive index of a highly exposed region at the time of interference exposure. Since there is no disclosure containing a metal component in a binder polymer, it is submitted that the present invention differs from the reference and is patentably distinguishable. Further, all polymerizable compounds having a siloxane group disclosed in the Examples have a low refractive index of 1.49 or less. This is similar to a methyl methacrylate/ethyl acrylate/acrylic acid copolymer used together as a binder polymer in the examples. Therefore there is no disclosure or suggestion to obtain a hologram having a large refractive index modulation amount in such a manner that the refractive index of the film obtained is changed or affected by a metal atom incorporated in a binder resin to change the refractive indices with the photopolymerization reactive compound.

Therefore, the feature of the present invention including the use of the organic-inorganic hybrid polymer, the organometallic compound capable of performing hydrolysis and polycondensation in combination, improved physical film properties and a refractive index of the film obtained itself being changed by the incorporation of a metal atom to enlarge the difference of refractive index modulation with the photopolymerization reactive compound are simply not anticipated by Sato.

Applicants respectfully submit that it would have not been obvious to modify the process of Maeda et al. by using producing a reactive sol-gel matrix containing epoxide moieties based upon the disclosure of Sato et al. to be compatible and that epoxide containing reactive binder are desirable in holographic recording media to form the epoxide containing polymerizable matrix. However, the feature of the present invention is, as previously mentioned, to use an organic-inorganic hybrid polymer having a metal component capable of performing hydrolysis

and polycondensation on a principle chain of an organic polymer in a pendant shape and an organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation in combination.

As described, the conception to have excellent processing properties by imparting the flexibility of the organic polymer and the rigidity and durability heat resistance imparted by the inorganic polymer in combination to provide the desired film physical properties cannot be anticipated by Sato et al. and Maeda et al.

Even if one of ordinary skill in the art viewed the disclosures of Baney et al. and Krug et al. into account, as for a photosensitive composition for volume hologram recording, together it is submitted that the presently claimed invention cannot be considered to be anticipated or obvious as there is no disclosure either explicitly explicit or implicit of a large refractive index modulation be achieved using the change of refractive index of a film obtained itself and obtain film physical property improvements by selecting an organic-inorganic hybrid polymer of the subject application which is obtained by copolymerizing an organometallic compound represented by the general formula 1 and a monomer having an ethylenically unsaturated bonding and further using the organic-inorganic hybrid polymer in combination with the organometallic compound represented by the general formula 2 capable of performing hydrolysis and polycondensation.

For the reasons mentioned above, the presently claimed invention as amended is submitted to not be obvious in view of these references. Accordingly, Applicants respectfully submit that the amended claimed invention has been patentably distinguished over the aforementioned references.

In further support of claims 13-24, Applicants state that the feature of providing a photosensitive composition and a photosensitive medium for volume hologram recording as

defined in claims 13, 19 and 20 using an organic-inorganic hybrid polymer having a silicon compound capable of both hydrolysis and polycondensation on a principle chain of an organic polymer in a pendant shape and/or a hydrolyzed polycondensate of said organic-inorganic hybrid polymer in combination with an organometallic particle having a photopolymerization reactive group capable of exhibiting a refractive index different from that of a hydrolyzed polycondensate of said organic-inorganic hybrid polymer is not disclosed alone in any reference of record or by combination if permissible. The organometallic particle of the present invention is a compound that at least one photopolymerization reactive functional group is bonded on the surface of the metallic particle (p. 49, lines 13-17). It is different from a coupling agent or polymers of coupling agents.

The photosensitive composition and photosensitive medium of the present invention as defined in claims 13, 19 and 20, include the organic-inorganic hybrid polymer having a silicon compound which functions as a binder component having low refractive index and capable of performing hydrolysis and polycondensation. Thus, a volume hologram having a large refractive index modulation amount between a binder and a refractive index modulation component can be obtained by selecting a metal of the organometallic particle, which is the photopolymerization reactive compound mentioned above and functions as a refractive index modulation component.

Further, since the organic-inorganic hybrid polymer is used as a binder polymer, the resultant film has a flexible portion and a rigid portion in the chain providing flexibility, durability and heat resistance. The inorganic polymer provides excellent processing properties. The dispersibility of the organometallic particle is excellent due to the inorganic portion of the hybrid polymer, and the photosensitive composition is easily prepared for use a uniform coating liquid due to the dispersibility of this particle.

Accordingly, the photosensitive composition and photosensitive medium provide a volume hologram capable of realizing a large refractive index modulation and excellent physical properties of the film are obtained.

In item 18 of the Action, it is asserted that it would have been obvious to modify the process of Maeda et al. by using producing a reactive sol-gel matrix containing epoxide moieties in view of the disclosure of Sato et al. It is further stated that these references would be compatible and that epoxide containing reactive binder desired in holographic recording media, using technique are similar to those disclosed by Baney et al. and Krug et al. to form the epoxide containing polymerizable matrix.

As previously mentioned, the present invention provides an organic-inorganic hybrid polymer having a silicon compound and/or a hydrolyzed polycondensate of said organic-inorganic hybrid polymer is used in combination with an organometallic particle which has a photopolymerization reactive group and is capable of exhibiting a refractive index different from that of the hydrolyzed polycondensate of said organic-inorganic hybrid polymer, a refractive index modulation amount between an organometallic particle which is photopolymerization reactive and a refractive index modulation component and a binder can be enlarged, a film obtained has a flexible portion and a tough portion in the chain and has excellent processing properties. Furthermore, the excellent dispersion properties of the organometallic particle due to the inorganic portion of the organic-inorganic hybrid polymer, and the photosensitive composition for volume hologram recording is easily prepared in a uniform coating liquid.

On the contrary, Maeda et al. only mentions that a network structure is solely comprised of chains of mutually bonded inorganic compounds, and that an organic group may be introduced as a side chain of the network structure of the inorganic network in a pendant shape. In Maeda et al., there is no disclosure of an organic-inorganic hybrid polymer having a metal

component capable of performing hydrolysis and polycondensation on a principle chain of an organic polymer in a pendant shape.

Also, Maeda et al. does not disclose the organometallic particle of the present invention. Nor does this reference imply the use of the organometallic particle, which has a photopolymerization reactive compound as a refractive index modulation component and is capable of exhibiting a refractive index different from that of the hydrolyzed polycondensate of said organic-inorganic hybrid polymer.

Therefore, the effect exhibited by the present invention using the organic-inorganic hybrid polymer having a silicon compound used in combination with the organometallic particle having a photopolymerization reactive group wherein the refractive index modulation amount can be enlarged is simply not disclosed. The resultant film having a flexible portion and a durable portion in the chain and having excellent processing properties is not achieved by this reference. Furthermore, the excellent dispersion property of the organometallic particle due to the inorganic portion of the organic-inorganic hybrid polymer and the photosensitive composition for volume hologram recording is easily prepared to be a uniform coating liquid. These features are not taught or contemplated by Maeda et al.

Similarly, Sato et al. does not mention the organic-inorganic hybrid polymer obtained by copolymerizing an organic silicon compound represented by the general formula 3 and a monomer having an ethylenically unsaturated bonding.

In fact, Sato et al. teaches that it is necessary for the polymer binder to have a good compatibility with a component (A) (a polymerizable polymer), and that the polymer binder may have a reactive group such as a cationic polymerizable group. However, these teachings fall short of disclosing the use the organic-inorganic hybrid polymer which is obtainable by copolymerizing the organometallic compound represented by the general formula 1 and the

monomer having an ethylenically unsaturated bonding so that, as a film physical property, it has the flexibility that the organic polymer has and the durability and the heat resistance those the inorganic polymer has in combination so as to have an excellent processing properties.

Further, though the compound having a siloxane group is used as a refractive index modulation component (a photopolymerizable compound), it is different and distinguishable from the organometallic particle used in the present invention wherein at least one photopolymerization reactive functional group is bonded on the surface of the metallic particle. Sato et al. does not explicitly teach or imply the use of the organometallic particle, which has a photopolymerization reactive compound capable of exhibiting a refractive index different from that of the hydrolyzed polycondensate of said organic-inorganic hybrid polymer.

Therefore, the effect of the present invention as discussed hereinabove is submitted not to be obvious in view of Sato et al.

The conclusion that it would have been obvious to modify the process of Maeda et al. based upon the teaching of Sato et al to arrive what at Applicants' claimed invention is believed to be overcome. The features of the present invention using the organic-inorganic hybrid polymer including a silicon compound capable of performing hydrolysis and polycondensation and the organometallic compound having a photopolymerization reactive group in combination is simply not met by these references alone or in combination as it is not possible to conceive to use the organic-inorganic hybrid polymer having a silicon compound capable of performing hydrolysis and polycondensation and the organometallic particle having a photopolymerization reactive group in combination, that a volume hologram having thereby a large refractive index modulation amount between a binder and a refractive index modulation component can be obtained, and further that the film physical property of the film obtained improves from any one of these references taken alone or in combination.

Even if one skilled in the art were to take the disclosures of Baney et al. and Krug et al. into account, it is submitted to not be possible to easily arrive at the volume hologram of the instant invention as claimed.

For the reasons mentioned above, the present invention is submitted not to be made obvious in view of the cited references. Favorable reconsideration is respectfully requested.

Respectfully Submitted,

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